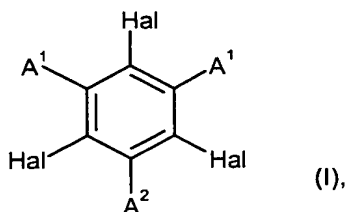


## Claims

### 1. Metal complexes of general formula I



in which

Hal stands for bromine or iodine,

A¹ stands for the radicals

—CONR¹-(CH₂)<sub>n</sub>-NR²-(CO-CHZ¹-NH)<sub>m</sub>-CO-CHZ²-K,

—CONR¹-(CH₂)<sub>p</sub>-(CONR²CH₂)<sub>m</sub>-CHOH-CH₂-K,

—CH₂O-(CH₂)<sub>p</sub>-CHOH-CH₂-K,

—CH₂-O-(CH₂)<sub>n</sub>-NR¹-(CO-CHZ¹-NH)<sub>m</sub>-CO-CHZ²-K,

—CH₂-NR¹-CO-(CHZ¹-NH-CO)<sub>m</sub>-CHZ²-K,

A² has the same meaning as A¹ or in the case that A¹ has the meaning first mentioned above can also stand for the radical —NR¹-CO-(NR¹)<sub>m</sub>-(CH₂)<sub>p</sub>-NR²-(CO-CHZ¹-NH)<sub>m</sub>-CO-CHZ²-K,

in which R¹ and R², independently of one another, mean a hydrogen atom,

a C<sub>1</sub>-C<sub>2</sub>-alkyl group or a monohydroxy-C<sub>1</sub>-C<sub>2</sub>-alkyl group,

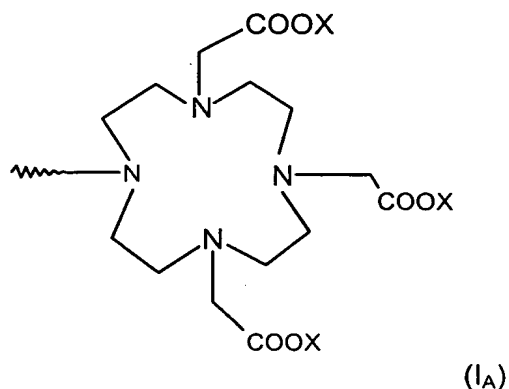
Z¹ and Z², independently of one another, mean a hydrogen atom or a methyl group,

n means the numbers 2-4,

m means the numbers 0 or 1 and

p means the numbers 1-4,

K stands for a macrocyclic compound of formula I<sub>A</sub>



with X in the meaning of a hydrogen atom or a metal ion equivalent of atomic numbers 20-29, 39, 42, 44 or 57-83, provided that at least two X stand for metal ion equivalents and optionally present free carboxy groups optionally are present as salts of organic and/or inorganic bases or amino acids or amino acid amides.

2. Metal complexes according to claim 1, characterized in that A<sup>1</sup> stands for a group:

- CONH(CH<sub>2</sub>)<sub>2,3</sub>NHCOCH<sub>2</sub>NHCOCH(CH<sub>3</sub>)-,
- CONH(CH<sub>2</sub>)<sub>2,3</sub>NHCOCH<sub>2</sub>NHCOCH<sub>2</sub>-,
- CONH(CH<sub>2</sub>)<sub>2,3</sub>NHCOCH<sub>2</sub>-,
- CONH(CH<sub>2</sub>)<sub>2,3</sub>NHCOCH(CH<sub>3</sub>)-,
- CONHCH<sub>2</sub>CH(OH)CH<sub>2</sub>-,
- CON(CH<sub>3</sub>)CH<sub>2</sub>CH(OH)CH<sub>2</sub>-,
- CH<sub>2</sub>OCH<sub>2</sub>CH(OH)CH<sub>2</sub>-,
- CONHCH<sub>2</sub>CONHCH<sub>2</sub>CH(OH)CH<sub>2</sub>-,
- CH<sub>2</sub>NHCOCH<sub>2</sub>-,

$-\text{CH}_2\text{NHCOCH}(\text{CH}_3)-$ ,  
 $-\text{CH}_2\text{NHCOCH}_2\text{NHCOCH}_2-$ ,  
 $-\text{CH}_2\text{NHCOCH}_2\text{NHCOCH}(\text{CH}_3)-$ ,  
 $-\text{CH}_2\text{O}(\text{CH}_2)_2\text{NHCOCH}_2-$ ,  
 $-\text{CON}(\text{CH}_2\text{CH}_2\text{OH}(\text{CH}_2)_2\text{NHCOCH}_2-$ ,  
 $-\text{CH}_2\text{O}(\text{CH}_2)_2\text{N}(\text{CH}_2\text{CH}_2\text{OH})\text{COCH}_2-$ .

3. Metal complexes according to claim 1, wherein  $\text{A}^2$  stands for a

$-\text{NHCOCH}_2\text{NHCOCH}_2\text{NHCOCH}(\text{CH}_3)-$ ,  
 $-\text{NHCOCH}_2\text{NHCOCH}_2\text{NHCOCH}_2-$ ,  
 $-\text{NHCOCH}_2\text{NHCOCH}_2-$ ,  
 $-\text{NHCOCH}_2\text{NHCOCH}(\text{CH}_3)-$ ,  
 $-\text{N}(\text{CH}_3)\text{COCH}_2\text{NHCOCH}_2-$ ,  
 $-\text{NHCONH}(\text{CH}_2)_2\text{NHCONH}_2-$ ,  
 $-\text{NHCOCH}_2\text{N}(\text{CH}_2\text{CH}_2\text{OH})\text{COCH}_2-$ ,  
 $-\text{N}(\text{CH}_3)\text{COCH}_2\text{N}(\text{CH}_2\text{CH}_2\text{OH})\text{COCH}_2-$ .

4. Metal complexes according to claim 1, wherein X stands for a metal ion equivalent of atomic numbers 21-29, 42, 44, or 58-70.

5. Metal complexes according to claim 4, wherein X stands for a metal ion equivalent of the ions gadolinium(III), dysprosium(III), europium(III), iron(III) or manganese(II).

6. Pharmaceutical agents that contain at least one metal complex of general formula according to claim 1, optionally with the additives that are commonly used in galenicals.

7. Use of at least one metal complex according to claim 1 for the production of agents for x-ray diagnosis.

8. Use of at least one metal complex according to claim 4 for the production of agents for MRT diagnosis.

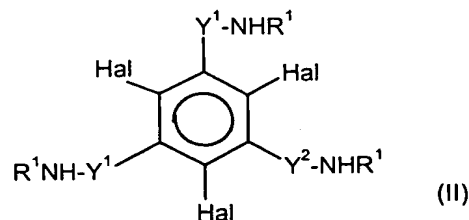
9. Pharmaceutical agents that each contain a metal complex according to claims 1 and 4 in a molar ratio of 2000:1 to 1:1, preferably 49:1 to 4:1.

10. Pharmaceutical agents according to claim 6, wherein the metal complex(es) dissolved or suspended in water or physiological salt solution is (are) present at a concentration of 0.001 to 1 mol/l.

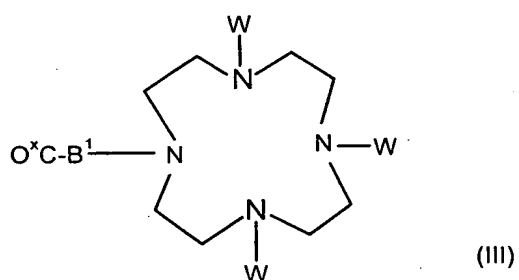
11. Use of at least one metal complex according to claim 1 for the production of agents for x-ray diagnosis and MR diagnosis of cerebral infarctions and tumors of the liver or space-occupying processes in the liver as well as tumors of the abdomen (including the kidneys) and the muscle-skeleton system and especially advantageously, the compounds can be used for the visualization of blood vessels after intraarterial and also intravenous injection.

12. Process for the production of the metal complexes of general formula I according to claim 1, wherein

a) a triiodo- or tribromoaromatic compound of general formula II



is reacted in a way that is known in the art with a macrocyclic compound of general



formula III

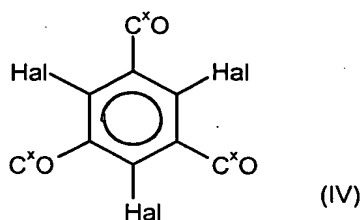
in which

$C^+O$  stands for a  $-COOH-$  or activated carboxyl group,

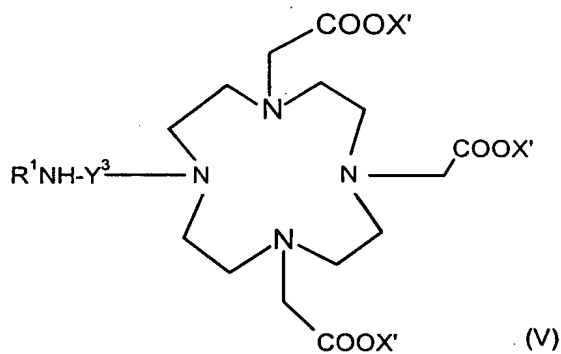
$W$  stands for a protective group or a  $-CH_2COOX'$  group with  $X'$  in the meaning of  $X$  or a protective group and  $-Y^1-NR^1-CO-B^1-$  stands for the radical  $A^1$  in the meaning of  $-CO-NR^1-(CH_2)_n-NR^2-(CO-CHZ^1-NH)_m-CO-CHZ^2-$  or  $-CH_2-O-(CH_2)_n-NR^1-(CO-CHZ^1-NH)_m-CO-CHZ^2-$  and  $Y^2-NR^1-CO-B^1$  for  $Y^1-NR^1-CO-B^1$  or for the case that  $Y^1-NR^1-CO-B^1$  has the meaning first mentioned above, the latter also stands for  $-NR^1-CO-(NR^1)_m(CH_2)_p-NR^2-(CO-CHZ^1-NH)_m-CO-CHZ^2-$ , whereby  $B^1$  means the radical on the first or second (viewed from  $K$ ) carbonyl group between  $-CO-$  and  $K$ , and  $Y^1$  or  $Y^2$  stands for the deficient radical of the linker group that is reduced by one imino group, and then optionally protective group  $W$  is removed and the radical  $CH_2COOX$  is

introduced in a way that is known in the art or the protective group that optionally stands for  $X'$  is removed and then reacted in a way that is known in the art with a metal oxide or metal salt of an element of atomic numbers 20-29, 39, 42, 44 or 57-83 or

b) a triiodo- or tribromoaromatic compound of general formula IV



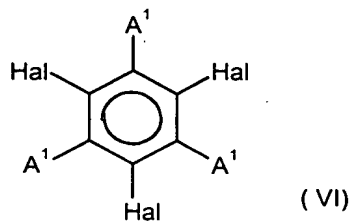
is reacted in a way that is known in the art with a macrocyclic compound of general



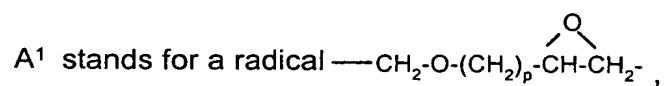
formula V

in which  $-C^xO$  and  $X'$  have the above-mentioned meaning and  $-CO-NR^1-Y^3$  stands for radical  $A^1$  in the meaning of  $-CONR^1-(CH_2)_p-(CONR^2CH_2)_m-CH(OH)CH_2-$  and thus  $Y^3$  is in the meaning of  $-NR^1-(CH_2)_p-(CONR^2CH_2)_m-CH(OH)CH_2-$ , and then the protective group that optionally stands for  $X'$  is removed and then is reacted in a way that is known in the art with a metal oxide or metal salt of an element of atomic numbers 20-29, 39, 42, 44 or 57-83 or

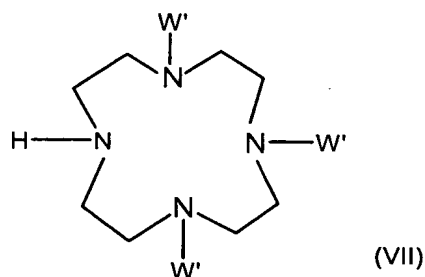
c) a triiodo- or tribromoaromatic compound of general formula VI



in which

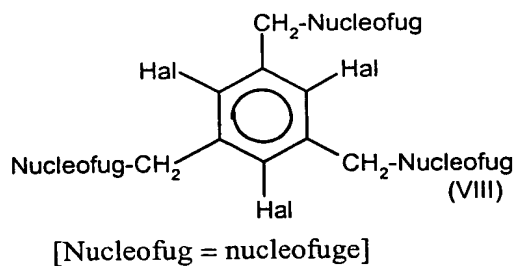


is reacted in a way that is known in the art with a cyclene of general formula VII



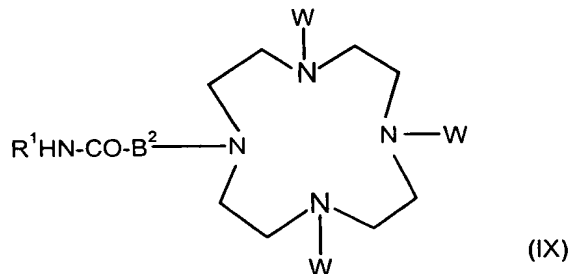
in which  $W'$  stands for a hydrogen atom or a protective group, after the optionally present protective groups have been removed and then radical  $\text{—CH}_2\text{COOX}$  has been introduced in a way that is known in the art, to form a metal complex of general formula I with A in the meaning of radical  $\text{—CH}_2\text{—O—(CH}_2\text{)}_p\text{—CHOH—CH}_2\text{—}$  or

d) a triiodo- or tribromoaromatic compound of general formula VIII



in which nucleofuge stands for a nucleofuge group,

is reacted in a way that is known in the art with a macrocyclic compound of general



formula IX

in which

$R^1$  and  $W$  have the above-mentioned meanings, and  $B^2$  stands for the radical  $-(CHZ^1-NHCO)_m-CHZ^2-$  and then is further processed as indicated under a), such that metal complexes of general formula I are obtained with  $A^1$  in the meaning of radical  $-CH_2-NR^1-CO-(CHZ^1-NHCO)_m-CHZ^2$ , whereby then optionally in the metal complexes, obtained according to a)-d), of general formula I, still present acid hydrogen atoms are substituted by cations of inorganic or organic bases, amino acids or amino acid amides.

13. Process for the production of the pharmaceutical agents according to claim 6, wherein the complex compound that is dissolved or suspended in water or physiological



salt solution, optionally with the additives that are commonly used in galenicals, is brought into a suitable form for enteral or parenteral administration.